(12) UK Patent Application (19) GB (11) 2 228 695 (13) A

(43) Date of A publication 05.09.1990

(21) Application No 9004425.6

(22) Date of filing 28.02.1990

(30) Priority data
(31) 8902529 (32) 03.03.1989 (33) DE

(51) INT CL[5]
B23B 31/117 29/02

(52) UK CL (Edition K)
B3B BHS9
B3C C1B6D C1B6L C1B6N

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) B3B BHS6 BHS9
INT CL[4] B23B

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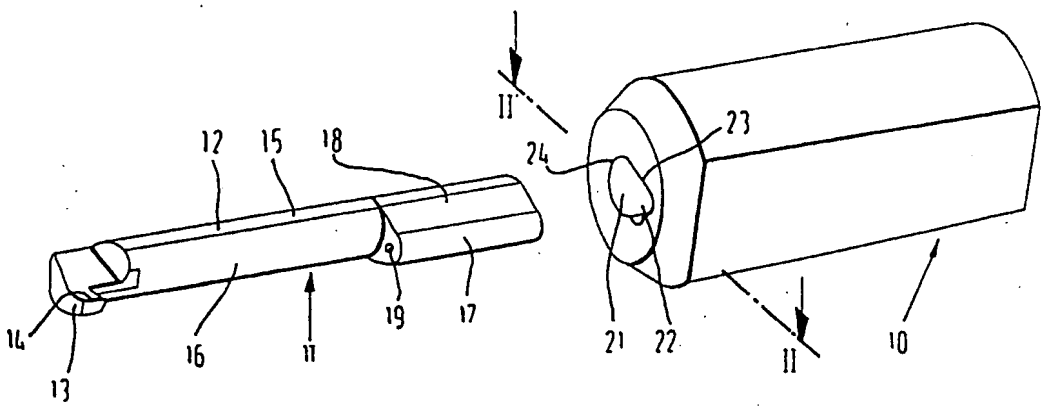
(54) Internal cutting tool and holder

(57) The holder 10 is associated with the hook-ended tool 11, having a shank 12 clampable in a receiving holder recess 21 by a clamping means, for example, a screw. Diametrically opposite the clamping means, the receiving recess 21 has a radial extension 22 for a radial projection 17 on the shank 12 of the hook-ended tool 11. When the shank 12 is clamped in the holder 10, the radial projection 17 abuts on clamping surfaces 23 of the extension 22 which converge radially outwardly and precisely define the position of the hook-ended tool. The respective surfaces may be flat with a groove cut into one clamping surface 23 to provide for three-point contact. Alternatively the clamping or projection surfaces are concave and convex with the other surfaces flat, to provide the three-point contact. Coolant can be supplied through a bore 19.

Fig.1



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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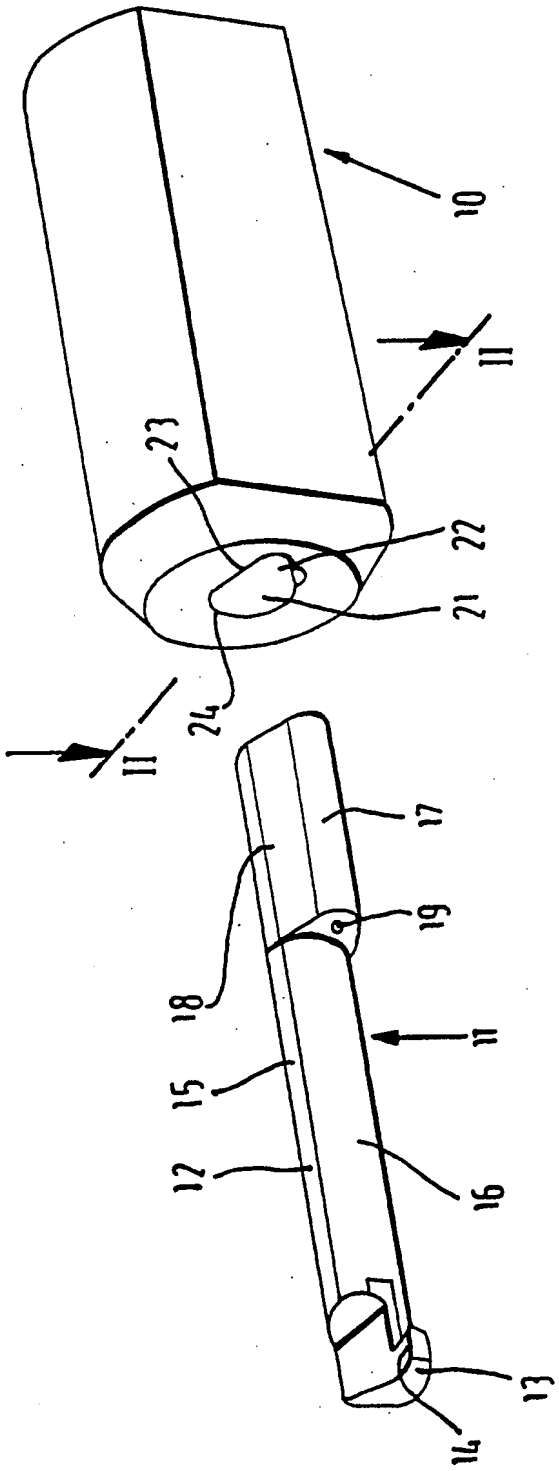


Fig.1

Fig.2

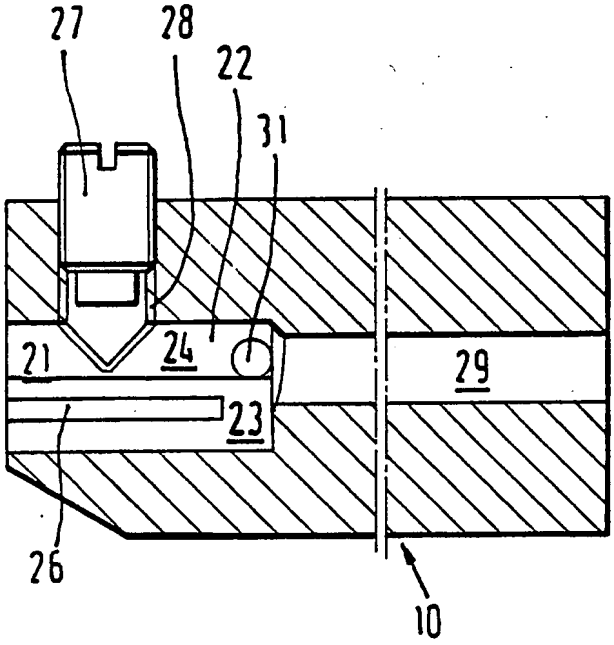


Fig.3

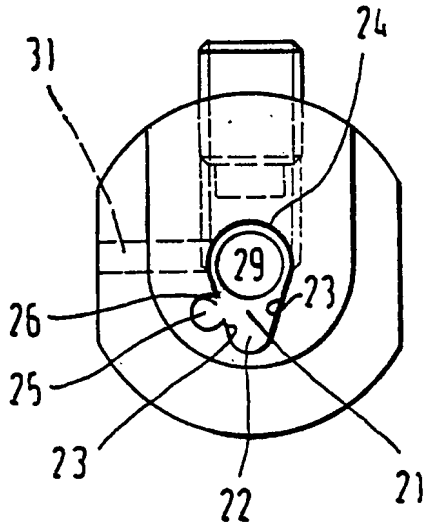


Fig.4

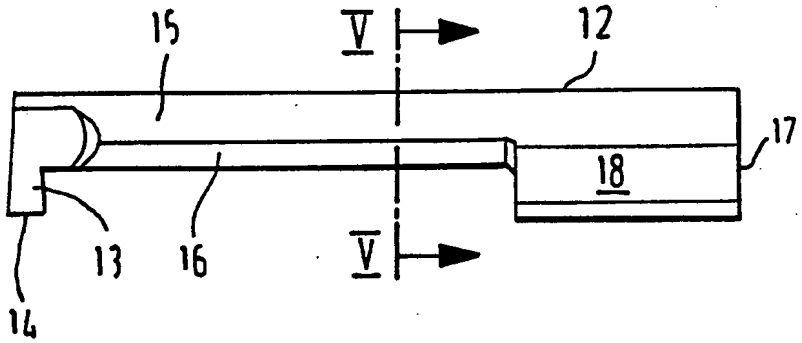
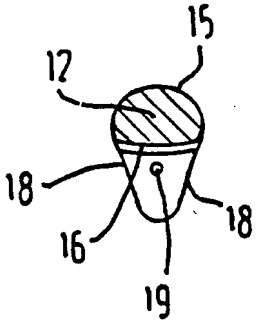


Fig.5



Internal Turning Chisel

The invention relates to an internal turning chisel for machining the inside surface of bores, for example, for cutting circumferential grooves in the bore wall, precision turning the bore wall, cutting a thread in a bore wall and the like.

In this context "internal turning chisel" is understood as the whole tool which is clampable in a machine tool and comprises a clamping holder, a hook-ended tool with a shank having a cutting edge at its hooked end, a receiving recess in the clamping holder for receiving the shank of the hook-ended tool and a clamping means for clamping the shank of the hook-ended tool in the receiving recess of the clamping holder. It is known to provide a clamping screw as clamping means.

The object underlying the invention is to provide an internal turning chisel with which optimum conditions for the cutting operation are achievable.

This object is accomplished in accordance with the invention by an internal turning chisel with the above-mentioned features which exhibits the following features:

a) the receiving recess has on one side thereof a radial extension with facing walls which form clamping surfaces which converge radially outwardly from the longitudinal axis of the receiving recess,

b) for engagement in the extension of the receiving recess, the shank of the hook-ended tool has a radial projection having radially outwardly converging abutment surfaces for at least partial abutment on the clamping surfaces of the extension, and

c) the clamping means is arranged in generally diametrically opposed relation to the radial extension of the receiving recess.

With the inventive design of the internal turning chisel, both the known clamping screw and a clamping wedge which engages the receiving recess longitudinally or transversely thereto may be provided as clamping means.

When the inside wall of a bore is being machined for cutting circumferential grooves, the cutting edge of the tool has a radial direction of advance. The cutting edge must lie as precisely as possible in a diametral plane of advance of the bore being machined which extends parallel to this radial direction of advance. Only if the cutting edge is in this position is an optimum clearance angle obtained. Spacings of the cutting edge from the diametral plane of advance result in clearance angles which adversely affect the cutting operation by, for example, causing the tool to oscillate. Therefore, action of the clamping means, for example, tightening of the clamping screw must result in a very exact rotary position of the tool in the clamping holder which must also not change to a noticeable extent when the tool is sub-

jected to stress. Spacings of the cutting edge from this diametral plane are particularly critical when bores with a small diameter are to be machined since even a slight spacing varying from zero causes a great change in the clearance angle.

To achieve a precise rotary position of the shank of the hook-ended tool in the clamping holder, the shank of known hook-ended tools has a flat portion on which the end of the clamping screw acts. The invention is based on the fact that the position of the cutting edge cannot be clearly defined by this alignment of the hook-ended tool. There must be a certain amount of play between the shank of the hook-ended tool and the receiving recess in order for the hook-ended tool to be insertable into the receiving recess at all. Tightening of the clamping screw causes the surfaces of the shank opposite the clamping screw to be pressed against the wall of the receiving recess. The resulting frictional force can, if the flat portion is not oriented exactly perpendicularly to the longitudinal axis of the clamping screw, prevent further alignment while the clamping screw is tightened, which results in an arbitrary position of the cutting edge within the aforementioned play relative to the diametral plane of advance. Also, when the hook-ended tool is subjected to stress during the cutting operation, a torque is exerted on the hook-ended tool which may result in a slight deformation of the flat portion and the clamping screw and hence in a change in the position of the cutting edge perpendicularly to the diametral plane of advance.

On the basis of knowledge of these interrelationships, a precisely defined rotary position of the hook-ended tool is achieved by virtue of the invention by the radial extension of the receiving recess according to feature a) and the radial projection on the shank of the hook-ended tool according to feature b) bringing about a defined abutment of the abutment surfaces of the radial projection on the clamping surfaces of the extension by the action of the clamping means arranged in accordance with feature c). At the same time, a change in the cutting edge position perpendicular to the diametral plane of advance when the tool is subjected to stress is thereby avoided as the rotary position of the tool in relation to the clamping holder is secured by the abutments of the abutment surfaces on the clamping surfaces acting on a radius which is larger than the radius of the receiving recess.

To enable machining of bores with an extremely small diameter, it is advantageous for the hook-ended tool to be of integral design. Further advantages are to be gained by the hook-ended tool consisting of hard metal. Owing to the large modulus of elasticity of hard metal, the cutting edge remains precisely in the originally adjusted position even when subjected to relatively high stresses and so a change in the cutting edge position in relation to the diametral plane of advance is practically excluded in the event of stress.

In a further advantageous configuration of the inventive

internal turning chisel, provision is made for the clamping holder to be provided with a coolant bore and the radial projection of the hook-ended tool with a recess extending axially through it and for the coolant bore and the recess to be interconnected when the hook-ended tool is clamped in the clamping holder. The inventive design of the hook-ended tool of the internal turning chisel according to the invention with a radial projection on the shank enables provision of a coolant bore or a coolant groove in or on the radial projection without impairing the solidity of the shank of the hook-ended tool.

The invention and its further advantageous developments are explained in detail in the following description of an embodiment.

The drawings show:

Figure 1 a perspective illustration of the disassembled internal turning chisel;

Figure 2 a section along line II-II in Figure 1;

Figure 3 a front view of the clamping holder;

Figure 4 a side view of the hook-ended tool; and

Figure 5 a section along line V-V in Figure 4.

The embodiment of an internal turning chisel according to the invention illustrated in Figure 1 comprises a clamping holder 10 for a hook-ended tool 11. The hook-ended tool 11 has a shank 12 with a hooked end 13 for a cutting edge 14. On the side 15 facing away from the cutting edge 14, half of the shank 12 is of circular-cylindrical configuration. The side 16 of the shank facing the cutting edge 14 is flat. A radial projection referred to hereinafter as fin 17 extends from this flat side of the shank 12 at the end thereof remote from the cutting edge 14. The fin 17 has flat abutment surfaces 18 converging outwardly from the longitudinal axis of the shank. A bore 19 for a coolant extends through the fin in the longitudinal direction of the shank 12 at a short distance from the flat side 16 of the shank.

The clamping holder 10 comprises for the hook-ended tool 11 a receiving recess 21 into which the end of the hook-ended tool 11 having the fin 17 is insertable with play. This receiving recess 21 has on one side thereof a radial extension 22, the facing walls of which form flat clamping surfaces 23 which like the abutment surfaces 18 of the fin 17 converge radially outwardly, thereby including an angle which is identical with the angle formed by the abutment surfaces 18 of the fin 17. The two clamping surfaces 23 lie in imaginary planes which intersect on an imaginary line of intersection extending parallel to the longitudinal axis of the clamping holder 10. The wall portion 24 of the receiving recess located opposite this imaginary line of intersection of the clamping sur-

faces is of circular-cylindrical configuration and extends over somewhat more than 180 degrees and so the clamping surfaces lie at a tangent to the circular-cylindrical wall portion. A bore 25 is located beside the one clamping surface 23 on one side of the receiving recess 21 and intersects this clamping surface 23, thereby interrupting it with a gap 26.

On the side of the receiving recess 21 which is diametrically opposed to the imaginary line of intersection of the clamping surfaces, a radial threaded bore 28 is provided in the clamping holder 10 for a clamping screw 27.

A bore 29 for supplying a coolant extends in the longitudinal direction of the clamping holder 10 from the receiving recess 21 to the other end of the clamping holder. A further bore 31 for a pin, not illustrated in the drawings, acting as stop for the hook-ended tool 11, extends perpendicularly to the longitudinal axis of this bore 29 likewise into the receiving recess immediately adjacent to the bottom thereof.

The bore 25 and hence the slot 26 terminate at a short axial spacing from the bore 31.

To insert the internal turning chisel, the hook-ended tool 11 is inserted with its right-hand end in Figures 1 and 4 into the receiving recess 21 of the clamping holder 10 until it strikes the pin inserted in the bore 31. The clamping screw 27 is then screwed in so its in-

side end presses the hook-ended tool downwards in Figure 2, whereby the abutment surfaces 18 of the hook-ended tool 11 are pressed against the clamping surfaces 23 of the receiving recess 21. The hook-ended tool 11 is thereby placed in a precisely defined play-free position relative to the clamping holder 10 which does also not change when subjected to stress.

In order to avoid a change in the position of the cutting edge 14 of the hook-ended tool when subjected to stress, the hook-ended tool consists of sintered hard metal.

This precise fixing of the rotary position of the hook-ended tool 11 with respect to the clamping holder 10 and the angular position of the cutting edge 14 with respect to the clamping holder 10 which remains unchanged even when subjected to stress make it possible for bores with an extremely small diameter to be precisely machined with the thus designed internal turning chisel.

The slot 26 made by the bore 25 in the one clamping surface 23 results in a three-faced support for the abutment surfaces 18 of the fin 17 of the hook-ended tool 11, whereby a particularly precise angular position of the hook-ended tool 11 relative to the clamping holder 10 is achievable.

In an embodiment which is not illustrated, at least the clamping surface 23 that is located opposite the

interrupted clamping surface may be designed as a platform which protrudes slightly beyond the corresponding wall of the extension 22 as this furthers the accuracy even if this surface should become worn.

While the inside wall of a bore is being machined by the illustrated internal turning chisel, a coolant is introduced through the bore 29 into the space created by the stop pin 31 and then travels from there through the bore 19 in the fin of the hook-ended tool 11 to the cutting edge 14. The delimitation of the bore 25 and hence of the slot 26 results in the latter being closed off by the fin 17 and so the flow of the coolant is essentially through the bore 19 only. Instead of the bore 19, the fin 17 may also be provided with a groove, not illustrated in the drawings, which extends through it in the axial direction.

Another possibility, not shown in the drawings, for achieving a precise angular position of the hook-ended tool relative to the clamping holder is for one of the abutment or clamping surfaces to be of concave and the other of convex configuration and for the clamping or abutment surfaces, respectively, which cooperate with these to be substantially flat, in order to obtain a three-line abutment of the abutment surfaces 18 of the radial projection on the clamping surfaces 23 of the extension 22.

In the illustrated embodiment, the hook-ended tool 11

with the hooked end 13 and the fin 17 is of integral design. It is, however, also possible for the cutting edge 14 to be on a cutter plate which is soldered to the hooked end 13.

The foregoing description and the drawings relate to the features which are essential to the materialization, by way of example, of the invention. Therefore, insofar as features are disclosed in the description and drawings but are not mentioned in the claims, these serve, if necessary, to also define the subject of the invention.

What is claimed is:

1. Internal turning chisel comprising
- a clamping holder,
- a hook-ended tool which has a shank which is provided with a cutting edge at its hooked end,
- a receiving recess in said clamping holder for receiving said shank of said hook-ended tool, and
- a clamping means for clamping said shank of said hook-ended tool in said receiving recess of said clamping holder,

characterized in that

a) said receiving recess has on one side thereof a radial extension with facing walls which form clamping surfaces which converge radially outwardly from the longitudinal axis of said receiving recess,

b) for engagement in said extension of said receiving recess, said shank of said hook-ended tool has a radial projection having radially outwardly converging abutment surfaces for at least partial abutment on said clamping surfaces of said extension, and

c) said clamping means is arranged in generally diametrically opposed relation to said extension of said receiving recess.

2. Internal turning chisel as defined in claim 1, characterized in that said clamping surfaces of said

extension adjoin said receiving recess in said clamping holder, thereby lying at a tangent to this receiving recess.

3. Internal turning chisel as defined in claim 1 or 2, characterized in that said radially outwardly converging clamping surfaces of said receiving recess in said clamping holder coincide substantially with imaginary flat surfaces which intersect on a straight line parallel to said longitudinal axis of said receiving recess.

4. Internal turning chisel as defined in one of claims 1 to 3, characterized in that to form a three-face support for said abutment surfaces of said hook-ended tool, the one clamping surface of said extension is interrupted by a gap which extends in the direction of said longitudinal axis of said receiving recess.

5. Internal turning chisel as defined in claim 1 or 2, characterized in that to form a three-line abutment of said abutment surfaces of said radial projection on said clamping surfaces of said extension, one of said abutment or clamping surfaces is of concave and the other of convex configuration, and the clamping or abutment surfaces, respectively, which cooperate with these are of flat configuration.

6. Internal turning chisel as defined in one of claims 1 to 5, characterized in that said receiving recess in

said clamping holder has a circular-cylindrical wall portion with said clamping surfaces of said extension adjoining it.

7. Internal turning chisel as defined in one of claims 1 to 6, characterized in that said hook-ended tool is integral.

8. Internal turning chisel as defined in one of claims 1 to 7, characterized in that said hook-ended tool consists of hard metal.

9. Internal turning chisel as defined in one of claims 1 to 8, characterized in that said clamping holder is provided with a coolant bore and said radial projection of said hook-ended tool with a recess extending through it in the axial direction, and in that said coolant bore and said recess are interconnected when said hook-ended tool is clamped in said clamping holder.

10. Internal turning chisel as defined in one of claims 1 to 9, characterized in that a clamping screw or a clamping wedge is provided as clamping means.

11. Internal turning chisel substantially as hereinbefore described with reference to the accompanying drawings.

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